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DFO Atlantic Fisheries
Research Document 95/13

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MPO Pêches de l'Atlantique
Document de recherche 95/13

STATUS OF ATLANTIC SALMON IN THE RICHIBUCTO RIVER IN 1994

by

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104-07181/

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ABSTRACT

Angling effort on the Richibucto River is low and catch estimates are not made. First Nation harvest was 45% of 1993 levels for large salmon and 102% for small salmon. A mark-recapture experiment placed too few tags to estimate returns and spawning escapement; a qualitative assessment assuming a similar exploitation rate to previous years in the First Nation food fishery for large salmon indicated that spawning requirements were not met in 1994. Juvenile densities at sites surveyed suggested that spawning has not been adequate in recent years. These results indicate that there is no harvestable surplus of Atlantic salmon from the Richibucto River. At present, sufficient information on stock status has not been accumulated to forecast returns.

RÉSUMÉ

L'effort de pêche à la ligne dans la rivière Richibucto est faible et ne fait pas l'objet d'estimations de prises. Par rapport à celles de 1993, les prises des premières nations s'établissaient à 45 % pour ce qui est des grands saumons et à 102 % en ce qui concerne les petits saumons. Le nombre d'étiquettes apposées lors d'une expérience de marquage-recapture a été insuffisant pour estimer les montaisons et l'échappée de reproducteurs; une évaluation qualitative, fondée sur un taux d'exploitation hypothétique des grands saumons comparable à celui de l'année précédente dans la pêche de subsistance des premières nations, dénotait que les besoins de reproduction n'ont pas été comblés en 1994. Les densités de juvéniles sur les lieux étudiés permettent de penser que le frai a été insuffisant ces dernières années. Ces résultats révèlent qu'il n'y a pas de surplus de saumon de l'Atlantique a récolter dans la rivière Richibucto. À l'heure actuelle, on n'a pas accumulé suffisamment de renseignements sur l'état du stock pour prévoir les montaisons.

SUMMARY SHEET
Salmon in the Richibucto River

	1989	1990	1991	1992	1993	1994	MIN	MAX	MEAN
First Nation Harvest									
Large	32	73	82	452	253	113	32	452	178
Small	16	93	51	61	50	51	16	93	54
Spawning escapement									
Large				467					
Small				80					
Total returns									
Large				1119					
Small				142					
Percent target met									
Large				81	Below	Below			
Small				26	Below	Below			
% egg target met									
				83	Below	Below			

Description of Fishery: Angling effort is very low and catch is not estimated. Big Cove First Nation harvests salmon by gillnet and trapnet.

Target: 2.942 million eggs; 626 large salmon, 270 small salmon.

Fishery Data: None.

Research Data: Juvenile densities were determined at several sites, a stream habitat survey was begun, and biological data from the 1993 sample are presented.

Estimation of Stock Parameters: Returns were qualitatively assessed assuming a similar exploitation rate in the First Nation fishery from 1992 to 1994.

Assessment Results: Spawning escapement was probably not met in 1994.

Ecological Considerations: Salmon by-catch in commercial gear may have a significant effect on the stock.

Future Prospects: No forecast is available.

Management Considerations: There is no harvestable surplus of salmon from the Richibucto River.

Introduction

The Richibucto River is situated in Kent County, New Brunswick and flows in an easterly direction to Northumberland Strait in Statistical District 76, Salmon Fishing Area 16 (Figs.1,2). It is a complex system of separate rivers emptying into one large estuary (Fig.3). A spawning run of Atlantic salmon enters the system during September and October, and is exploited for food by Indian Island and Big Cove First Nations and for public recreational angling. Information on stock status is required to manage salmon harvest on the Richibucto, ensuring that adequate spawning escapement occurs on a sustainable basis. Under Aboriginal Fisheries Strategy agreements signed with First Nations, the Department of Fisheries and Oceans provides funding and training to develop a co-management approach to the resource.

The stock on this river has been assessed previously, for 1992 and 1993 (Atkinson and Claytor 1994). This was accomplished through a mark-recapture experiment in cooperation with Big Cove First Nation, under the federal government's Aboriginal Fisheries Strategy (AFS). For 1992, returns were estimated from tags applied at First Nation trapnets, and recovered in the First Nation gillnet fishery. In 1993 insufficient tags were placed to permit a mark-recapture population estimate: returns were qualitatively compared with 1992 assuming a similar trap efficiency and exploitation rate in the First Nation fishery for both years. Estimated spawning escapement did not meet target in either year. In 1994 there was no AFS agreement signed with Big Cove, and no mark-recapture experiment was conducted. A late agreement was concluded with Indian Island First Nation and a marking trapnet was built and installed in the estuary near the town of Richibucto. The trap operated from October 8 to November 6 but only one salmon was caught. Consequently, it is not possible to quantitatively assess the Richibucto stock for 1994.

Habitat survey data, results of electroseining at several sites during the summer of 1994, and by-catch data from commercial fishing gear in the estuary, were provided by the Southeast Anglers Association.

Description of Fisheries

Commercial

Commercial harvesting of Atlantic salmon ceased in 1984. The harvest from 1967 to 1983 in SFA 16 was presented in Atkinson and Claytor (1994).

First Nations

Big Cove First Nation currently harvests salmon by gillnet and

trapnet from the Richibucto River during September and October (Table 1). In 1994, 113 large (63 cm or more) and 51 small (less than 63 cm) salmon were harvested for food. This was 55% fewer large salmon than in 1993 and 2% more small fish. However, catch was not recorded before October 4. Indian Island First Nation did not harvest salmon in 1994.

Recreational

Recreational angling effort is low and catch estimates are not available. There is no leased water, and the river is not listed as either a designated or scheduled salmon river by the New Brunswick Department of Natural Resources and Energy (DNRE). Kelts may be angled from April 15 to May 15, bright salmon from June 8 to October 31. The bright season was extended in 1993 from October 15 to the end of the month. Prior to 1984 all kelts and bright fish could be retained; in 1984 large salmon kelts could be kept but all large bright salmon had to be released. Beginning in 1985, regulations have required all large salmon (brights and kelts) to be released, and only small salmon could be retained. In 1992, the season limit for small salmon was reduced from ten to eight, and this regulation remains in effect.

Other

Estimates of unrecorded catch are obtained from fishery officers (DFO, DNRE, First Nation) and represent known or suspected removals in the estuary or freshwater due to by-catch in other gear or poaching. No apprehensions of individuals or gear were made in 1994 with respect to illegal salmon catch. A survey of by-catch in the Richibucto estuary in gaspareau traps (June), smelt traps (November), and eel traps (August, September, October) conducted by the Southeast Anglers Association found no incidence of salmon (Appendix 1).

Target

The required number of spawners for the Richibucto was calculated using Method 2 recommended by Randall (1985) for the Miramichi River. The number of spawners needed to meet egg deposition requirements was calculated assuming all egg deposition came from large salmon. The numbers of small salmon required were calculated assuming that at least one male spawner was needed for each female large salmon. Average fecundity values were assumed to be equivalent to Miramichi stock based on river proximity. Since the sample size available for the Richibucto is small, sex ratios have been assumed to be the same as in the Bouctouche, the nearest river for which sufficient data is available.

Egg deposition rate = 2.4 eggs/square meter (Elson 1975)

Rearing area = 1,226,000 square meters (Anon 1978)

Fecundity : Large salmon, 6816 eggs; Small salmon, 2908 eggs
(Randall 1985)

Sex ratio : Large salmon; 69% female, 31% male
: Small salmon; 12% female, 88% male

Eggs/large salmon : 6816 x 0.69 = 4703

Eggs/small salmon : 2908 x 0.12 = 349

Eggs required : 2.4 eggs/sq m x 1,226,000 sq m
= 2.942 million eggs

Large salmon required : 2,942,000 / 4703 = 626

Large salmon females : 626 x 0.69 = 432

Large salmon males : 626 - 432 = 194

Small salmon males required to balance sex ratio : 432 - 194
= 238

Small salmon required (total) : 238 / 0.88 = 270

Research Data

Mark/Recapture

In cooperation with Indian Island First Nation, a trapnet was operated in the tidal portion of the river to mark salmon. This was located on the south side of the river channel opposite the town of Richibucto (Fig.3). The box portion of the trap measured 3.9 m (13') wide by 18.3 m (60') long and was constructed with 5.7 cm (2.25") mesh knotless nylon. A single leader of approximately 53 m (175'), extending from a door in the middle of the long side of the box, was made from 11.4 cm (5.5') mesh polypropylene. Salmon caught in the trap were to be marked with small blue Carlin tags attached with a single wire through the back behind the first ray of the dorsal fin, measured, sexed on external characters, scale sampled for ageing, and released. The trap was operated from October 8 to November 6, but only one salmon was caught, tagged and released.

Electroseining

In September and October of 1994 members of the Southeast Anglers Association electroseined at three locations on the main stem of the Richibucto River and one on Coal Branch River, to determine densities and percent habitat saturation (PHS) of juvenile salmonids (Fig.3). Due to the small areas available of separate habitat type (riffle, run, pool), several sections of each were fished and the results pooled to represent a larger area. This resulted in one "site" each on the main stem and Coal Branch, representing each of the three habitat types. Sites were open, and methods used were as described in Zippin (1958), and Grant and Kramer (1990). A PHS value around 27 is considered optimum; above this a greater than 50% chance exists that a density dependent response will occur. All PHS values were well below optimum, suggesting that spawning escapement in recent years has not been adequate (Table 2). No brook trout were found at these sites, and other species were not recorded.

Habitat Survey

A stream survey of 29.5 km of the main stem of the Richibucto was conducted during the summer of 1994 by the Southeast Anglers Association. Total habitat assessed was 318,504 square meters, which is only about 25% of the total currently used to calculate the spawning target (Table 3.).

Biological Characteristics

Ages of the sample collected in 1993 (Table 4.) show that 2+, 3+, and 4+ smolts comprised 35%, 56%, and 9% respectively, of known age fish. Of the multi-sea-winter component, 33% were repeat spawners. Mean length of large salmon was 76 cm, of small salmon 56 cm.

Estimation of Stock Parameters

A successful mark-recapture experiment was not conducted on the Richibucto in 1994, consequently, a quantitative estimate of returns and spawning escapement cannot be made. A comparison of First Nation Harvest in 1994 with that in 1993 and 1992 gives a qualitative indication of stock status.

Assessment Results

Total returns and Spawning Escapement

Spawning escapement in 1992 was 81% of target for large salmon

based on a mark-recapture estimate: in 1993 escapement was considered below target based on catches of large salmon at a research trapnet and in the Big Cove First Nation food fishery, which were 20% and 56% respectively of 1992 catches (Atkinson and Claytor 1994). The reported First Nation harvest of large salmon in 1994 was 25% of that in 1992 and 45% of 1993. Effort was similar in all years. Although not all of the 1994 catch was recorded, even if the harvest was double the reported figure it would still be reasonable to conclude that escapement of large salmon was below target again in 1994.

Sources of uncertainty

To obtain abundance indices for salmon on the Richibucto River it is necessary to operate at least one trapnet in a suitable location on an ongoing basis, and two are needed to estimate returns from a mark-recapture experiment. This could be accomplished through the timely installation and cooperative operation of traps between Indian Island and Big Cove First Nations, under the Aboriginal Fisheries Strategy.

The spawning target has been established for the entire Richibucto system, based on a rearing area calculated from total drainage area. The Richibucto is a complex system of separate rivers emptying into one large estuary. Ideally, each of these should be surveyed independently, and their extent of use as spawning habitat by salmon determined. Individual spawning targets for these various streams might provide a more realistic basis for deciding if returns are adequate for the streams for which they are destined, as determined at specific trap locations.

The validity of applying 2.4 eggs/ m^2 as an optimum deposition to all rivers is constantly challenged. Ways to refine this for individual rivers need to be sought.

Fecundity values used to derive target spawners from target egg deposition have been assumed from similar stock (Miramichi), rather than determined by direct measurement. This information could be obtained directly by First Nation guardians from the gillnet food fishery.

Angling catch and effort are not currently determined for the Richibucto. A cooperative logbook and/or creel census program with DNRE and the Southeast Anglers Association could provide useful information on angling in this system.

Ecological Considerations

The Richibucto estuary sustains a considerable commercial fishery for gaspareau, smelt, and eels. The unknown by-catch of juvenile and adult salmon may have a significant impact on the stock.

Forecast/Prospects

At present there is no reliable method of forecasting returns of Atlantic salmon to the Richibucto River. It may be possible to develop in-season forecasting using run-timing to trapnets when a sufficient number of years of operation have accumulated. Given a longer term data set, it may be possible to develop a stock/recruit relationship.

Management Considerations

The spawning target for the Richibucto has probably not been met in the years 1992 to 1993, indicating that there is no harvestable surplus.

Research Recommendations

1. Install mark and recapture traps in the estuary by the end of August in cooperation with Indian Island and Big Cove First Nations, to estimate returns to the system and possibly obtain an index of emigrating tagged adults.

2. Extend habitat surveys to more accurately determine rearing area for the system and refine spawning targets.

3. Extend the electroseining survey, with well defined protocols, to determine the extent of habitat use in the various rivers within the Richibucto system, and obtain juvenile densities to help validate spawning success.

4. Operate a counting fence on the main stem of the Richibucto and/or Coal Branch Rivers to estimate separately returns to these rivers, which are considered to be the most important spawning areas in the system.

5. Examine ways to refine the optimum egg deposition rate to establish more accurate spawning targets.

6. Obtain direct measurements of fecundity from First Nation food fishery to establish more accurate stock-specific spawning targets.

7. Establish a logbook and/or creel census program with DNRE and the Southeast Anglers Association to obtain data on angling catch and effort.

8. Monitor by-catch of salmon in commercial fishing gear to estimate the impact on stocks. Kelts caught in the gaspareau fishery may provide an index of spawning success.

Acknowledgements

We thank Indian Island First Nation for operating the trapnet on the Richibucto River (1994) and the collection of relevant data; members of the Southeast Anglers Association for collecting electroseining, habitat survey and by-catch data; and attendees of the Salmon Science Workshop for their input and suggestions (Append.2).

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Grant, J.W.A., and D.L. Kramer. 1990. Territory size as a predictor of the Upper limit to population density of juvenile salmonids in streams. Can. J. Fish. Aquat. Sci. 47: 1724-1737.

Randall, R.G. 1985. Spawning potential and spawning requirements of Atlantic salmon in the Miramichi River, New Brunswick. CAFSAC Res. Doc. 85/68.

Zippin, C. 1958. The removal method of population estimation. J. Wildl. Man. 22(1): 82-90.

Table 1. First Nation harvest of Atlantic salmon in the Richibucto River, 1982-94. NA, not available.

Year	Small	Large	Total	%Large
1982	20	84	104	81
1983	25	64	89	72
1984	47	44	91	48
1985	23	99	122	81
1986	76	69	145	48
1987	NA	NA	NA	-
1988	19	32	51	63
1989	16	32	48	67
1990	93	73	166	44
1991	51	82	133	62
1992	61	452	513	88
1993	50	253	303	84
1994	51	113	164	69
Mean(89-93)	54	178	233	76
94 +/- Mean	-6%	-37%	-30%	-9%

Table 2. Densities and Percent Habitat Saturation (PHS) of juvenile Atlantic salmon at two locations on the Richibucto R., 1994. Data provided by the Southeast Anglers Association.

Location	Habitat	Area sq.m	No. per 100 sq.m 0+	1+	2+	PHS
Richibucto R. (main)	Riffle	500	1.25	10.53	0.9	10
	Run	500	0	1.65	0	2
	Pool	500	0	0	0	0
Coal Branch R.	Riffle	495	15.24	1.82	0	5
	Run	574	1.56	2.49	0	3
	Pool	520	0	0.87	0	0

0+ = Fry: < and = 7.0 cm
1+ = Small Parr: 7.1 - 11.0 cm
2+ = Large Parr: > or = 11.1 cm

Table 3. Rearing area surveyed on the Richibucto River (main stem), 1994. Data provided by the Southeast Anglers Association.

Reach #	Reach Length (Km)	A Fastwater Area (m2)	B Pools Area (m2)	A + B Total Stream Habitat Area (m2)
1	4.5	13,963.8	10,805.9	24,769.7
2	3.9	23,132.5	3,510.0	26,642.5
3	4.0	24,054.7	4,735.2	28,789.9
4	1.9	12,931.0	3,428.3	16,359.3
5	2.1	14,114.8	10,471.5	24,586.3
6	1.6	15,551.2	6,962.9	22,514.1
7	2.6	32,820.0	421.2	33,241.2
8	2.8	40,714.2	199.6	40,913.8
9	1.5	23,616.3	480.0	24,096.3
10	1.5	22,278.9	0.0	22,278.9
11	1.1	19,032.2	752.8	19,785.0
12	1.0	16,537.5	279.1	16,816.6
13	1.0	17,334.4	375.9	17,710.3
Total	29.5	276,081.5	42,422.4	318,503.9

Table 4. Age distribution of Richibucto R. salmon, 1993.
SW = sea winter. Repeat spawner categories indicate total sea age, followed by sea ages at which fish spawned.

			Repeat Spawners		
Smolt Age	1SW	2SW	3.1	4.2	Total
2	7	0	0	1	8
3	6	5	1	1	13
4	2	0	0	0	2
?	2	1	0	0	3
Total	17	6	1	2	26

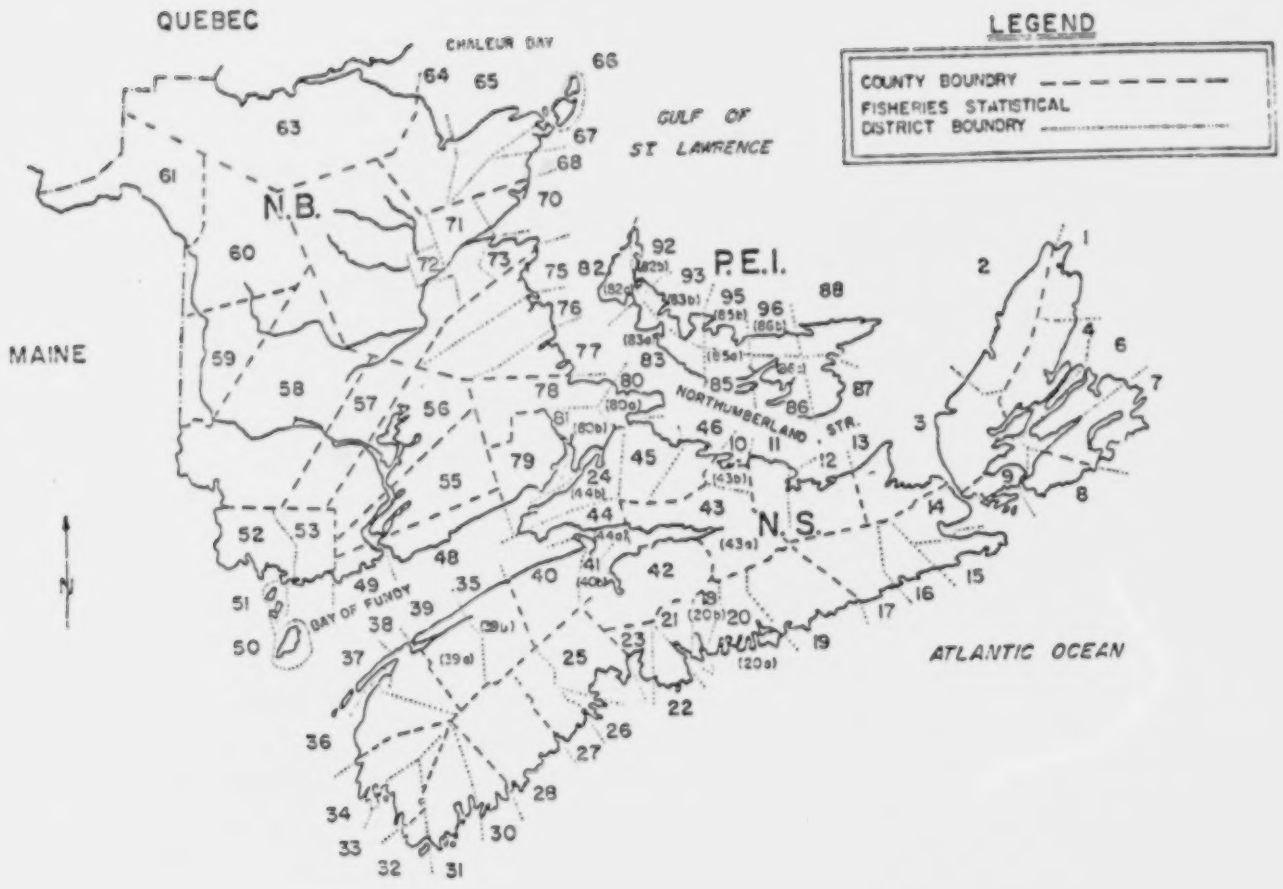

Figure 1. Fisheries Statistical Districts in Atlantic Canada.

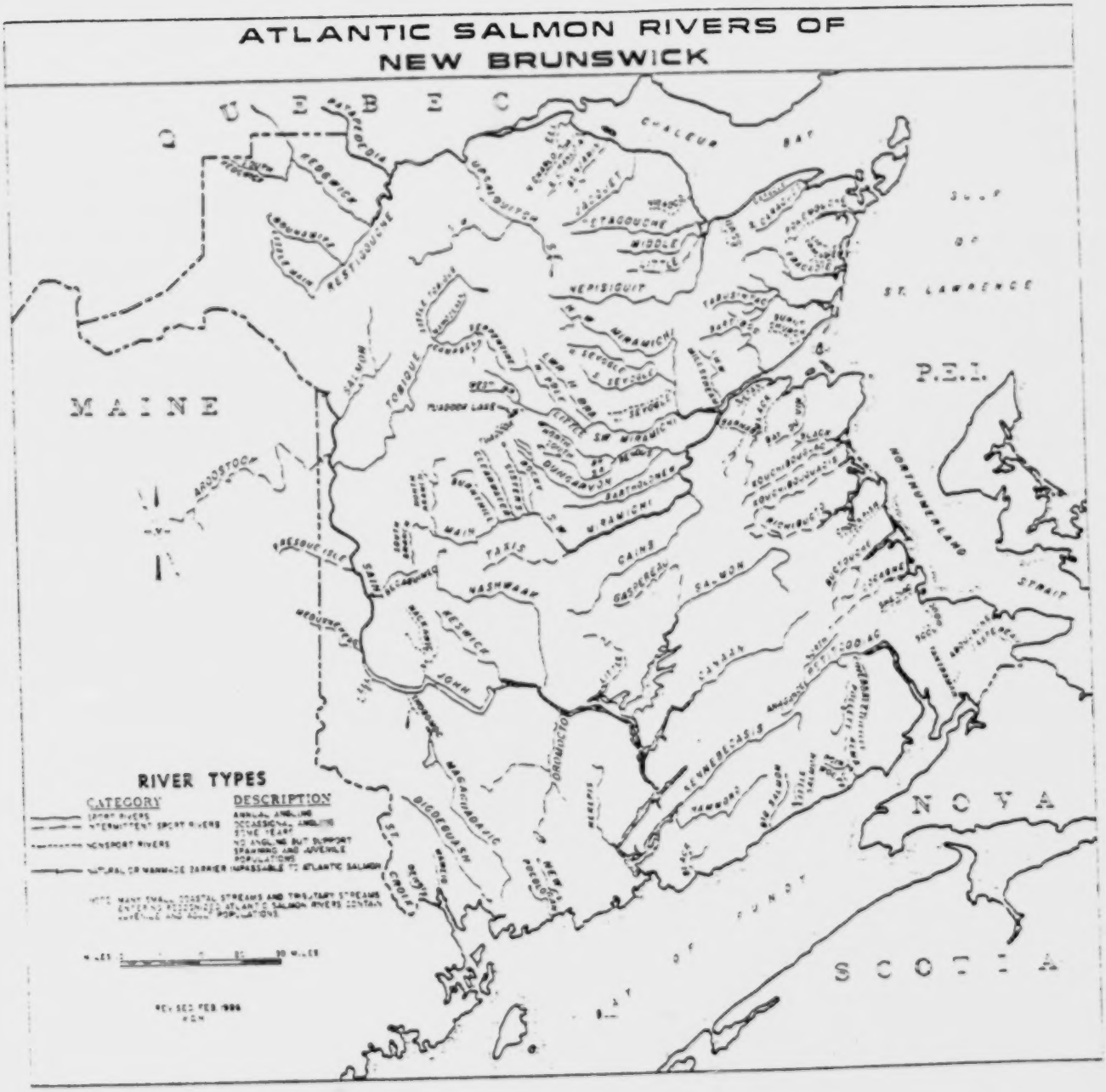

Figure 2. Atlantic salmon angling rivers of New Brunswick.
(Map prepared by DNRE)

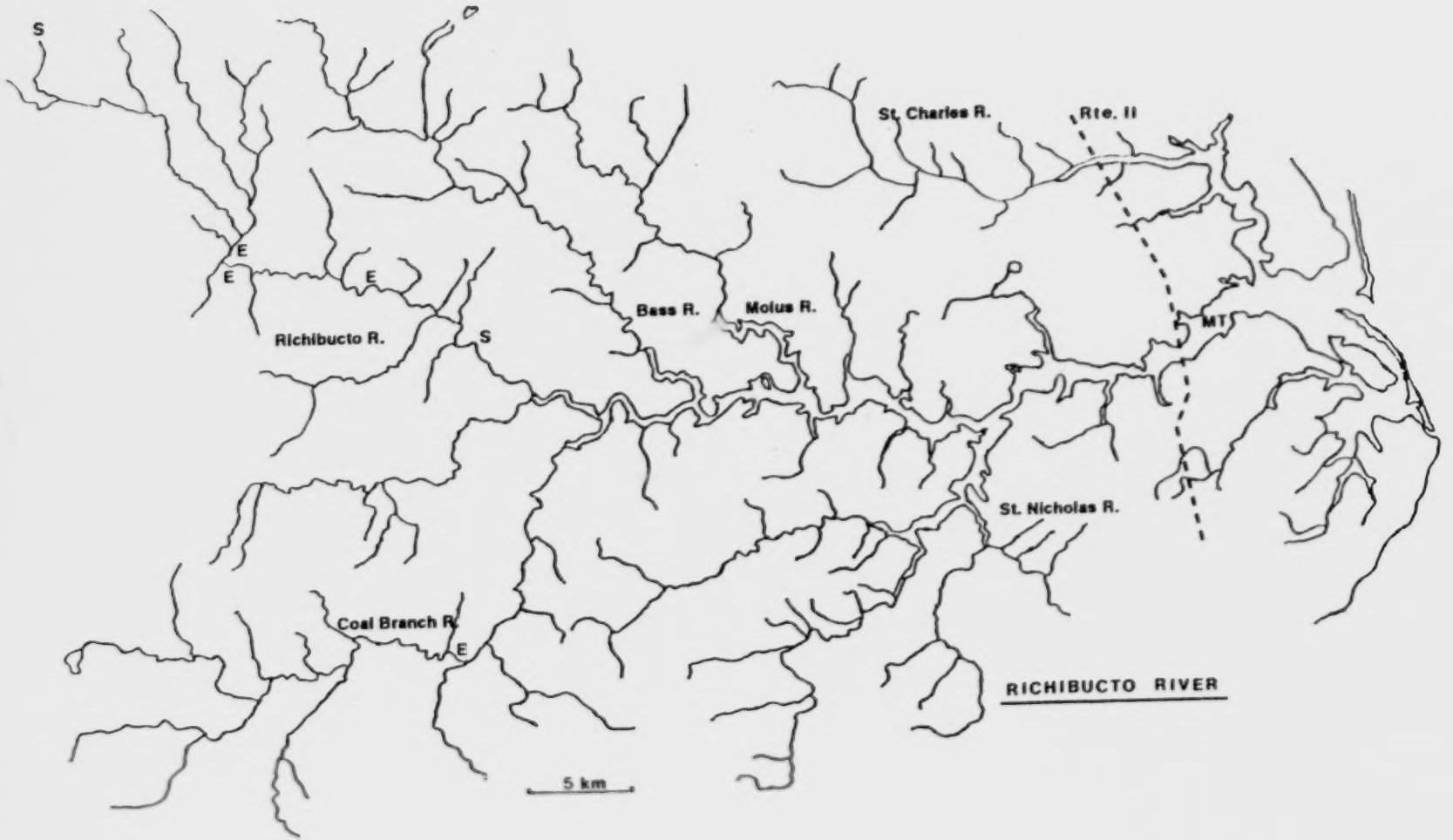

Figure 3. Location of trap, electroseining sites and habitat survey on the Richibucto River, 1994. MT - Mark Trap; E - Electroseining sites; S - Limits of habitat survey on main stem.

Appendix 1. By-catch data provided by Southeast Anglers Assoc.

Gaspareau Fishing By-Catch, 1994. - Richibucto River

Date	# of traps fished	SPECIES		
		Gaspareau	Trout	Other
06/02	2	90	0	21 bass; 3 perch; 30 flounder; 1 stingray; 1 chad; 40 crab
06/10	3	TNTC	1	57 bass; 11 perch; 1 eel; 1 lamprey; 8 flounder; 8 tomcod; 13 crab

TNTC = Too numerous to count.
Water Temperature - 12°C on June 6.
Trout Size - 33 cm (13 inches); 9 oz.
A total of 5 sites were monitored (See attached for site location).

1 - 33 cm (13 inches)

Eel Fishing By-Catch, 1994 - Richibucto River

Date	# of Traps Fished	# of Days Fished	Eel	Other
08/31	20	2	159	32 crab; 66 flounder; TNTC gaspareau; 11 cod; 43 tomcod; TNTC perch; 1 lobster; 1 capelin
09/07	4	1	19	40 flounder; 50 barbel; 1 lobster; 29 tomcod; 6 perch; 10 crab
09/28	24	2	85	13 perch
10/04	18	1	39	17 perch; 4 bass (< or = 15 inches)

Except for 09/28 and 10/04, only trout, salmon, perch, smelt, and bass were recorded as by-catch.

Appendix 1. (cont'd)

Smelt Fishing By-Catch, 1994 - Richibucto River

Date	# of Traps Fished	# of Days Fished	Smelt	Other
11/09	5	3	TNTC	TNTC tomcod; 100 flounder; 60 cod; 45 crab; 45 barbel; 50 perch; 1 bass (15 inches)
11/13	5	1	TNTC	70 crab; 65 tomcod; 50 cod; 5 flounder

Appendix 1. (cont'd)

Location of gear sampled for by-catch in the Richibucto estuary, 1994.

Appendix 2.

NOTES FROM THE RICHIBUCTO SALMON SCIENCE WORKSHOP

Community Centre, Indian Island First Nation
0930-1230 Hours, Friday, 9 December 1994

Chairperson:	
Ross Claytor	DFO, Science, Moncton
Notes:	
John Peppar	DFO, Science, Moncton
Attendees:	
Chief S.P. Barlow	Indian Island First Nation
Kenneth Barlow	Indian Island First Nation
Leon Sock	Big Cove First Nation
Gilles Cormier	Southeastern Anglers Association
Bill Hooper	NB DNRE, Fredericton
Tim Lutzac	DFO, Science, Moncton
Gary Atkinson	DFO, Science, Moncton

1. Introduction.

Some opening remarks were made by Chief Barlow.

He noted his First Nation's concerns over the ever-increasing effort being directed into the various fisheries resources of the Richibucto River system. With more and more people looking to the water to sustain their livelihoods, there is serious concern that the stocks will not be able to sustain this effort.

He provided examples of how spawning grounds of trout and striped bass are being heavily exploited (example: eel traps). There is very heavy exploitation of trout - from under the ice in winter and through bycatches in the eel traps in the spring. The traditional Indian way of mud-spearing eels was no longer being practiced, because of the over exploitation by the trap fisheries. This area used to be one of the best for striped bass angling. The numbers of bass have been severely reduced due to the fisheries now operating in the system. Concern was also raised over the impact of duck hunting and the use of lead shot.

Ross Claytor provided overviews of the stock assessment procedure, and the objectives of the meeting. He noted that presentations and points of discussion at this workshop would follow a format similar to that followed in a stock assessment, and be arranged under the following basic components: landings, target, data, status, etc.

Appendix 2. (cont'd)

From last years Richibucto River salmon assessment document, it was noted that not enough fish were captured to make a mark-recapture population estimate in 1993, so a qualitative assessment was made, based on changes in trapnet and First Nation harvests. Large and small salmon were below requirements in 1993.

Points of Discussion

Data

- Electrofishing and reconnaisance survey data were provided by the SE Anglers Association; a description of methods and coverage, and results obtained, will be included in the assessment document.
- Data re: bycatch in the gaspereau fishery was provided by the SE Anglers Association; no salmon were recorded or observed in their survey of gaspereau nets. Sites visits were made at eel and smelt fishing locations as well; no salmon bycatches were observed.
- It was noted by some members that bycatches of trout and salmon were likely much higher than indicated by the results obtained by the SE Anglers Association's surveys; there were evidences of considerable salmonid bycatches (some personal experiences were related).
- Members felt that some fisheries (such as those for eel) were operating too early for the intended species, and thus, taking bycatches (especially trout) and in fact, trying to do so. In addition, some individuals were fishing too many traps; the number of traps allowed per individual should be regulated (example: smelt fisheries).
- Big Cove First Nation catch of salmon to be provided; fishery did take place in 1994. Catch data should be broken down into small and large salmon components, so that the data can be treated as the other catch data, and be available to escapement calculations, etc.
- Indian Island First Nation fished trap for salmon; one salmon was caught. Some gill nets were fished and striped bass taken; no salmon bycatch was recorded in the gill nets.
- Good biological characteristics data are required from all salmon catches; these data are important to accurate calulation of spawning requirements, etc.

Appendix 2. (cont'd)

Status

- Data that we have, and what were provided at this meeting, will be included in an anadromous species status report, rather than a specific salmon assessment at this time.

Projects For Next Year:

1. Abundance Index of Salmon.

   Project for Indian Island First Nation - Install and operate trap early, and monitor all species caught. Prompt and early signing of fisheries agreement is needed, so that net can be installed by mid-August. Should re-evaluate the location for the trap; have to access main channel of river better than last year.

   Potential project for joint operation between Big Cove First Nation and Indian Island First Nation - Install and operate upriver trap or counting fence (to establish a recapture site), to make trapping procedure into a mark-recapture experiment.

   Ideally, two traps, plus counting fence, are needed to more adequately cover the entire Richibucto River system.

2. Electrofishing (juvenile assessment).

   Project for SE Anglers Association - Continue electrofishing survey; increase coverage of system (an additional 15-20 sites should be added to program).

3. Habitat assessment.

   Project for SE Anglers Association - Continue survey; increase coverage of system.

4. Bycatch assessment.

   Project for SE Anglers Association - Detail distributions of the different gears (gaspereau, smelt and eel fisheries). Then concentrate survey efforts where problems are expected to be the most prevalent. Total values of gaspereau, smelt and eel fisheries should be

Appendix 2. (cont'd)

documented (mean value per individual fisherman); to get an idea of the importances of these fisheries to the area, impact on the communities, etc.

5. Seals.

Information on seal populations in the area could be obtained from Parks Canada (Kouchibouguac); documentation of population trends, etc.

Richibucto Striped Bass

- Documentation needed on the following: Where do striped bass spawn? Does the species "home"? What areas should be sampled to get a good juvenile index of abundance?
- Investigators such as Brian Jessop and Kim Robichaud should be contacted for information re: possible methods and areas to sample for juvenile bass.

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